

IPC-2571

Generic Requirements for Electronics Manufacturing Supply Chain Communication – Product Data eXchange (PDX)



Endorsed by the National Electronics Manufacturing Initiative (NEMI)

IPC-2571

November 2001

A standard developed by IPC

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- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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- Contain anything that cannot be defended with data

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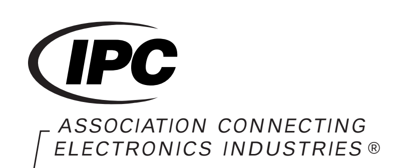
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IPC-2571



– GENERIC

Generic Requirements for Electronics Manufacturing Supply Chain Communication - Product Data eXchange (PDX)

A standard developed by the Product Data Exchange Task Group (2-15a) of the Supply Chain Communication Subcommittee (2-15) of IPC.

The IPC-2571 standard defines an XML encoding schema that enables a total product definition to be described at a level appropriate to facilitate supply chain interactions.

This project was initiated by the NEMI Virtual Factory Information Interchange Project (VFIIP) which established proof of concept. After completion, the project leaders recommended standardization by IPC under the ANSI rules and procedures.



November 20, 2001

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Product Data Exchange Task Group (2-15a) of the Supply Chain Communication Subcommittee (2-15) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Xiang Fu, Agile Software
Martin Zimmerman, Nortel Networks

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Introduction

Today, manufacturing is accomplished through the collaboration of a dynamic, global network of original equipment manufacturers, manufacturing service providers, and parts suppliers. To capture market opportunities, this network of partners is required to function even more efficiently than would a single company which kept control of all production processes in house.

Virtual manufacturing networks, such as these, are highly dependent on accurate and immediate product content information. Yet today's manufacturing networks are often forced to rely on inadequate paper-based communications like faxes and emails, or on web pages that are not dynamically linked to the source of the product content.

The dilemma is especially acute among organizations trying to bring electronic products to market. It is becoming increasingly rare for companies that design products, which have substantial electronics content, to manufacture their own products. It is more typical for the bulk of the manufacturing to be subcontracted to an Electronics Manufacturing Services (EMS) provider. The Original Equipment Manufacturer (OEM) who designs the product will typically only perform the final assembly and packaging but in some cases, even this is sub-contracted. The EMS provider may ship the finished product directly to customers. The EMS provider in turn will purchase the bulk of the components either directly from the component manufacturers or from distributors.

Increasingly, even the product design process is a collaborative effort. Often the Electronics Manufacturing Services provider or component supplier will suggest changes to a product design based on component price or availability information that is not available to the Original Equipment Manufacturer. The pressure to both reduce costs and improve products translates directly into a much higher frequency of product changes throughout a product's lifecycle. Effective and timely communication of these product changes across the supply chain is essential in order to avoid potentially costly rework or dead inventory problems.

PDX is the Product Data eXchange standard for the e-supply chain. Product Data eXchange is a multi-part standard, represented by the IPC 2570 series of specifications. The Product Data eXchange standardization effort is focused on the problem of communicating product content information between Original Equipment Manufacturers, Electronics Manufacturing Services providers and component suppliers. The standard is based on XML because this provides a simple yet powerful and flexible way to encode structured data into a format that is both human and machine-readable. The Product Data eXchange standard provides a way to describe product content (Bill of Materials (BOM), Approved Manufacturer Lists (AML), Drawings, etc.), Engineering Change Requests (ECR), Engineering Change Orders (ECO) and Deviations in an eXtensible Markup Language (XML) format. This standard will enable dramatic efficiency improvements throughout the supply chain since partners will have a way to exchange product content and changes in a common language.

The OEM companies at the top of the supply chain (SC), originate the product structure and feed it to the down stream SC partners. Various design for assembly, fabrication, test feedback (DF*) and material status, WIP and Quality information will flow back up the SC to the OEM (i.e. 257* standards). In some cases OEMs will be feeding data to both internal EMSs and multiple external EMSs and they need methods to make sense of this varying feedback. It is assumed that most SC partners will have several internal applications that they use to vault and control the product information (PDMs, ERPs, CAMs, CADs, etc).

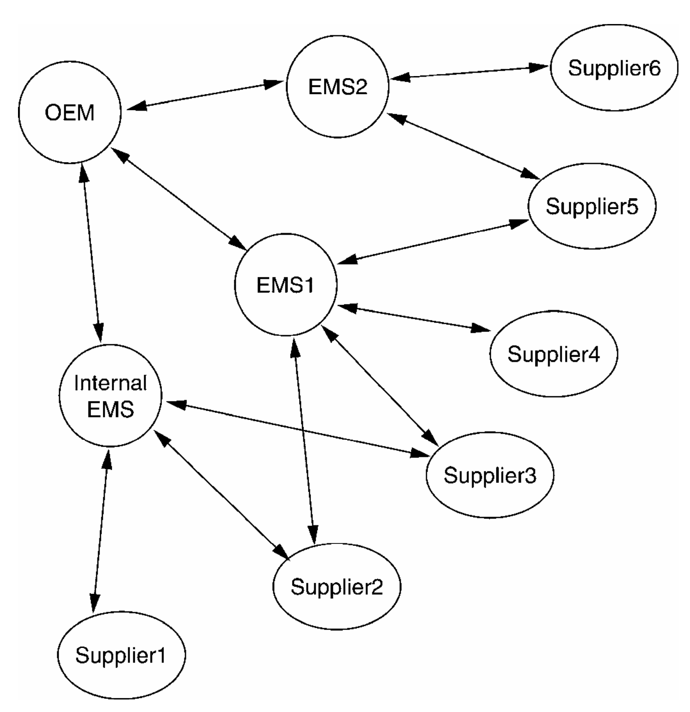


Figure 1 Supply Chain Information Exchange

As the product structure moves through the supply chain, various subsets of the product information will be made available to the suppliers and EMSs. Non Disclosure Agreements and security mechanisms are needed that allow this data to be shared in a secure and protected way. For example EMSs usually strip the PCB (Printed Circuit Board) information out of the full product data package before sending it on to the PCB fabricators. They also partition the BOM when they send quote packages to suppliers as part of the component procurement process. OEMs typically decide to partition the complete product structure and have different assemblies manufactured by several EMS companies.

To satisfy this mode of SC information exchange, IPC 257X allows all or portions of the product structure to be defined and transmitted. In some cases what appears as a “component” to one SC partner, may in fact be a complex assembly to another. The applications generating and processing this standard must be able to subset and merge the partial definitions into their company’s internal information models.

Relationships to Other Standards Initiatives

IPC 2510 – GenCAM

The GenCAM standard (IPC 2510) describes printed boards and printed board assemblies. GenCAM describes a printed board in enough detail to be able to manufacture and assemble a board. The Product Data eXchange standard, on the other hand, is intended for high-level supply chain communication of product definition data. Product Data eXchange allows a company to describe a complete system or sub-system including hardware and other higher-level assemblies that would not normally be described by GenCAM documents. Product Data eXchange does not however define a standard for describing parts and assemblies in enough detail to be able to manufacture them. This is achieved only by including other documents in a Product Data eXchange package. These other documents may include GenCAM documents. There is some overlap in scope between the bill of materials section of Product Data eXchange and the parts list section of GenCAM, however there are also significant differences. In a GenCAM file, the electrical characteristics of each device are described, as is the placement on the board of each instance of that device. A Product Data eXchange bill of material for a printed board assembly can be characterised as

a summary of a GenCAM parts list in the sense that it does not contain electrical characteristics or placement information. It may however also contain some information such as find numbers or information about mechanical fasteners, which is typically omitted from a GenCAM file. In general it should be possible for software to generate most of a Product Data eXchange bill of material from a GenCAM parts list but the reverse will not in general be possible. There are also some differences in the relative importance of some of the optional data that may be included both in a GenCAM parts list and a Product Data eXchange bill of material. Notably, both GenCAM and Product Data eXchange allow manufacturer part numbers to be recorded. This information may in some cases be omitted from a GenCAM parts list because the choice of which of the many possible manufacturer parts to use may not have been made at the time that the GenCAM file was generated. In a Product Data eXchange document this information will normally be required. Engineering Notes, examples, and other engineering related information that is used in a GenCAM file through the reference of attachments and utilizing workflow can be transmitted via the IPC2571 & IPC2578 series.

RosettaNet

RosettaNet is dedicated to the development and deployment of standard electronic business interfaces to align the processes between supply chain partners on a global basis. In order to efficiently conduct eBusiness, companies require a robust technical dictionary and data structures, a framework for passing messages, and conventions for business transactions. RosettaNet addresses these needs by building a master dictionary to define properties for products, partners, and business transactions. This master dictionary, coupled with an established implementation framework (exchange protocols), is used to support the eBusiness dialog known as the Partner Interface Process or PIP.

RosettaNet has well-defined Partner Interface Processes for the exchange of data about complete products and data about electronic components, and is embarking on developing a mechanism for exchanging manufacturing information. Product Data eXchange provides exactly this missing capability. It is anticipated that the data descriptions in Product Data eXchange will be leveraged into RosettaNet Partner Interface Processes to provide an end-to-end solution for the entire electronics supply chain.

Open Applications Group, Incorporated (OAGI)

The Open Applications Group, Incorporated has defined standard interfaces between enterprise software applications. The scope of the Open Applications Group, Incorporated Interchange Specification (OAGIS) overlaps to a small extent with the Product Data eXchange standard, and it is anticipated there will be opportunities for consolidation in the future.

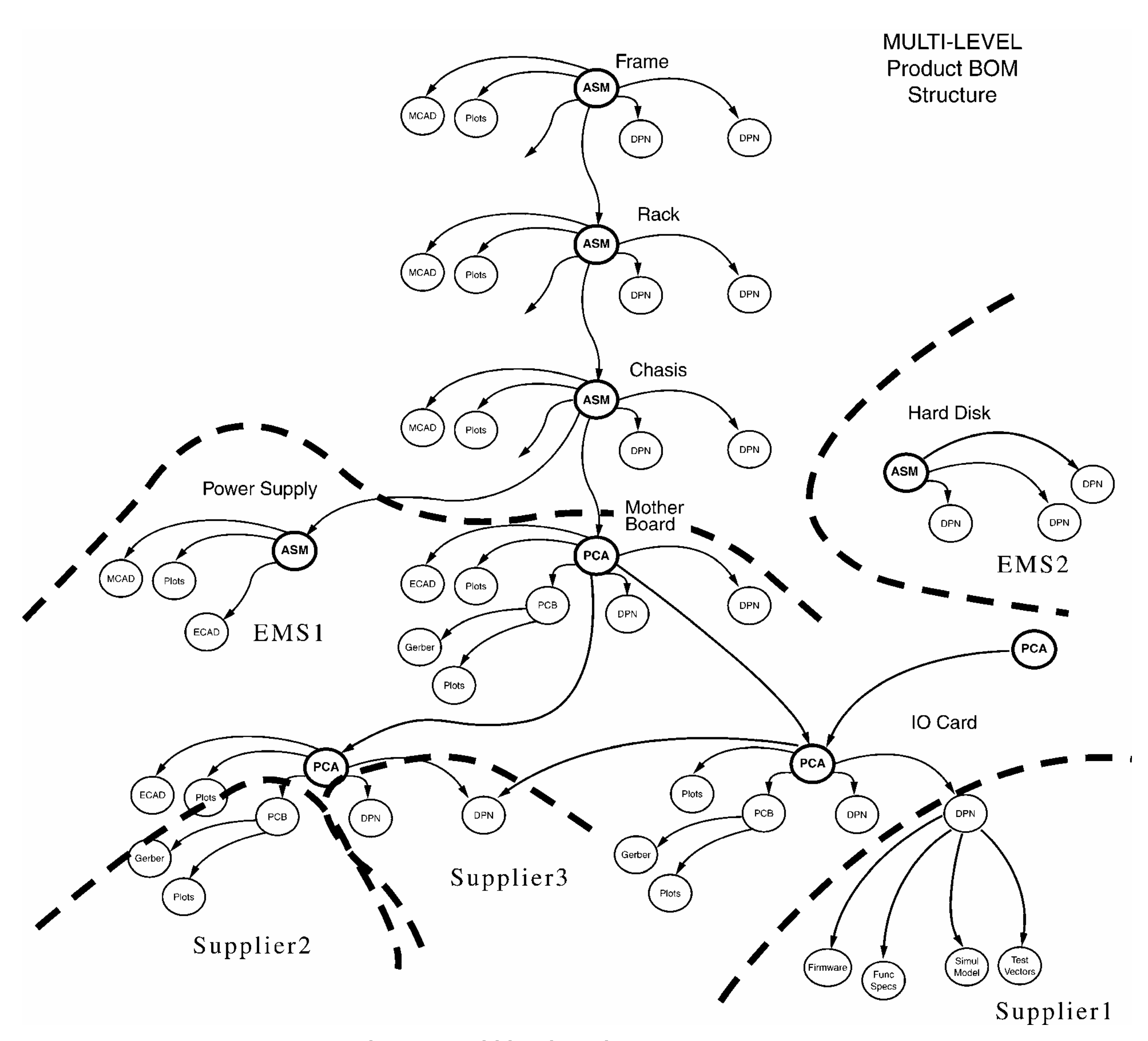


Figure 2 Multi-level Product BOM Structure

1 Scope

The Product Data eXchange 1.0 standard defines an XML encoding scheme that enables a total product definition to be described at a level appropriate to facilitate supply chain interactions. The scheme is defined for bill of materials (BOM), approved manufacturer list (AML), changes (Engineering, Manufacturing, Product) and references to documents describing geometric and other definition characteristics.

IPC 2571 is the umbrella specification for other IPC 2570-series specifications. It describes the Package element that is required for every Product Data eXchange implementation, as well as other common elements shared across the 2570 series. The sectional standards provide application exchange capability. IPC 2576, for instance, transfers as-built product configuration data, and IPC 2578 defines specific product definition elements such as items, changes, bills of material (BOMs), and approved manufacturing lists (AMLs).

The IPC 2570-series of standards transfer the data required to support the following business processes:

- Quote request
- Manufacturing
- Engineering change management (including signoff)
- Work in Process (not started)
- Report on Quality (in development)
- Report on as-built product configuration

2 Applicable Documents

The following documents are related to the Product Data eXchange efforts.

2.1 IPC Documents

The following documents contain provisions, which, through reference in this text, constitute provisions of this standard. All documents are subject to revision. Parties who make agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below.

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits.

IPC 2510 Generic Computer Aided Manufacturing Descriptions for Printed Boards and Printed Board Assembly.

IPC 2576 Product Data eXchange – Sectional Requirements for Electronics Manufacturing Supply Chain Communication of As-Built Product Data

IPC 2577 Product Data eXchange – Sectional Requirements for Supply Chain Communication of Manufacturing Quality Assessment

IPC 2578 Product Data eXchange – Sectional Requirements for Supply Chain Communication of Bill of Material and Product Design Configuration Data

2.2 RosettaNet Documents

The following are RosettaNet Partner Interface Process documents that relate to this standard, and reflect an effort made by both organizations towards harmonization.

RosettaNet PIPs	2C1-10 (IPC2578)	Product Design Information
	Segment 7A	Design Transfer
	Segment 7C	Distribute Manufacturing Information

2.3 OAG Documents

OAGIS Open Applications Group Interchange Specifications will be used to harmonize with this standard and will be incorporated in later revisions of this standard.

2.4 RFC Documents

RFC 1950 ZLIV Compressed Data format Specification 3.0

RFC 1951 DFLATE Compressed Data Format Specification Version 1.3

RFC 1952 GZIP file format specification 4.3

3 Product Data eXchange Package

This standard uses a single XML file in the format described by this specification to represent a Product Data eXchange (PDX) package. The Product Data eXchange package can reference external attachments (see attachments section below). The XML file will be named “pdx.xml”. The pdx.xml file must contain a single ProductDataeXchangePackage element and optionally the other elements described in this specification. The pdx.xml file may also contain elements from the other IPC 257x PDX standards.

Since a Product Data eXchange package can be one XML file and an unlimited number of external attachments, one way to communicate the Product Data eXchange package as a single package is to compress the files as described in Internet RFC's 1950 through 1952.. This not only brings all the files together in one file for ease of delivery, but also compresses the files to reduce their size. Compression is particularly useful for XML files since they tend to be very large with large amounts of repeated data and thus compress significantly. This compressed file consisting of the pdx.xml file and any external attachments can be named a Product Data eXchange file with a “.pdx” extension and the MIME type can be application/x-pdx. The compression of the Product Data eXchange package contents is optional and is not required by this specification. The sending and receiving partners must define this as part of the transport layer they use for communicating Product Data eXchange packages.

The Product Data eXchange package requires internal Document Type Definition (DTD) file inclusion so the entire content of the DTD file is included in the pdx.xml file. The DTD is included at the end of this document. In addition to the mandatory XML process instruction of <?xml version = "1.0"?>, or <?xml version = "1.0" encoding="UTF-8"?>, the pdx.xml file also includes two other process instructions: <?pdx_version = “1.0”?>, which states in which version of Product Data eXchange standard the package is formed, and <?generated_by SoftwareVendor/SoftwareName/Version/BuildNumber?>, which states which version of what software was used to create the package.

3.1 Modeling Diagram Occurrence Indicator Meanings

Occurrence indicators are used within element content models to specify how many times an element may appear at a given location. The indicators available to schema developers are listed below:

Occurrence Indicator	Meaning
none	The element must appear once and only once.
?	The element (or group of elements) may appear zero or one times. The element is optional, but is only allowed to appear once.
+	The element (or group of elements) must appear one or more times. The element is required to appear at least once, but multiple consecutive occurrences may be present.
*	The element (or group of elements) may appear zero or more times. The element can appear as many times consecutively as needed, or even zero times.

Note that graphics and a table of attribute descriptions are provided as an aid to understanding the elements in the PDX standard suite. In any instance where the XML DTD conflicts with an image or description, the DTD should be considered normative.

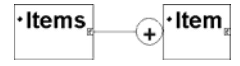
4 Pictorial Representation of IPC2570 Series

The following illustrations provide a graphical representation of some of the primary elements contained in the suite of Product Data eXchange standards:

4.1 Product Data eXchange Package

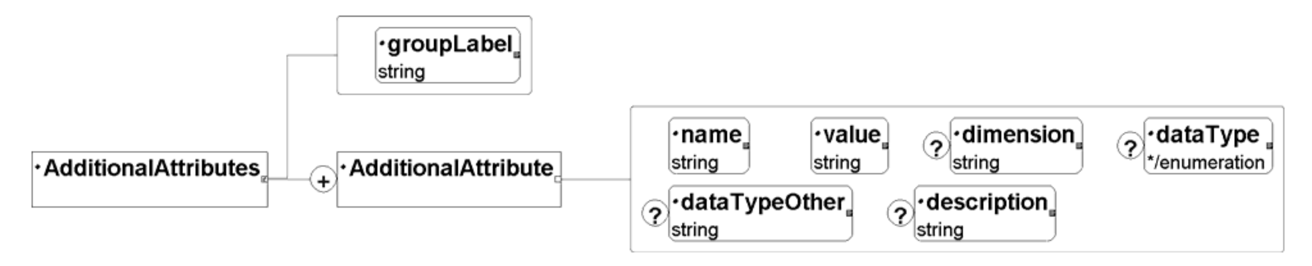


4.2 Items

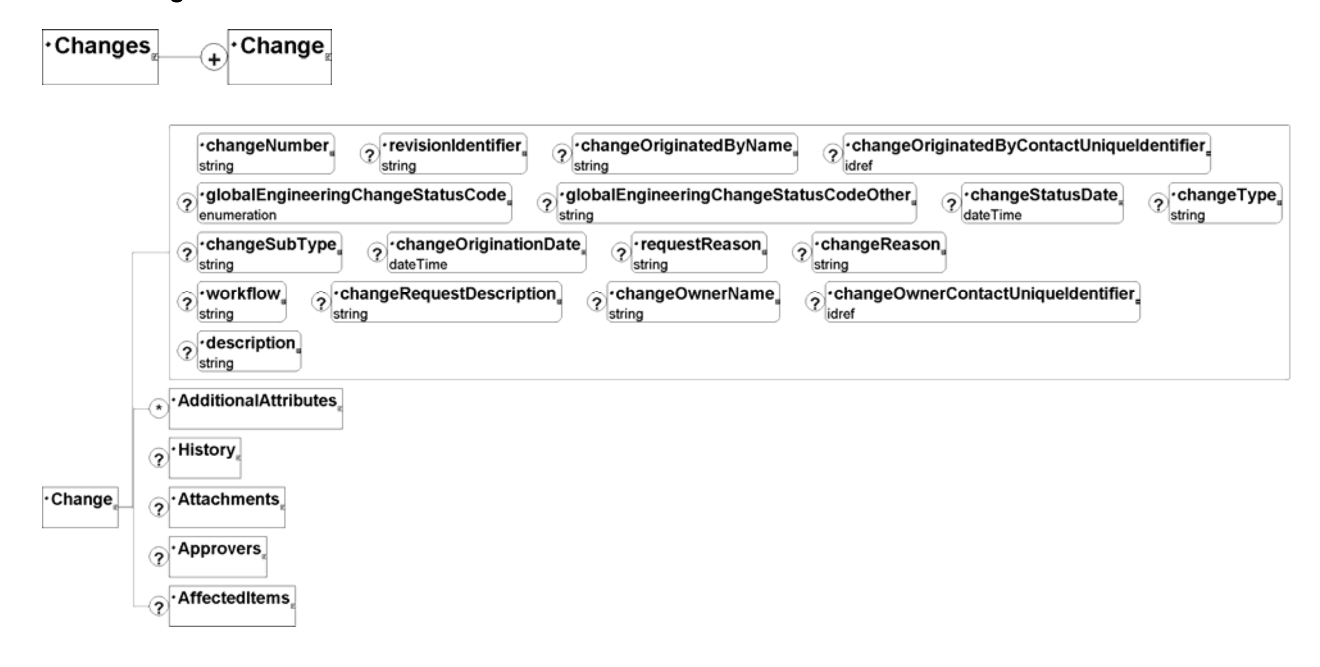


itemIdentifier
string
itemUniqueIdentifier
id
globalLifeCyclePhaseCode
enumeration
globalLifeCyclePhaseCodeOther
string
globalProductTypeCode
string
itemClassification
string
revisionIdentifier
string
versionIdentifer
string
proprietaryProductFamily
string
category
string
globalProductUnitOfMeasureCode
string
makeBuy
enumeration
makeBuyOther
string
minimumShippableRevision
string
revisionReleasedDate
dateTime
revisionIncorporatedDate
dateTime
isSerializationRequired
enumeration
isCertificationRequired
enumeration
ownerName
string
ownerContactUniqueIdentifier
idref
isTopLevel
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Attachments
Item
ChangeHistory
Characteristics
AlternateItems
SerialNumbers
AlternateIdentifiers

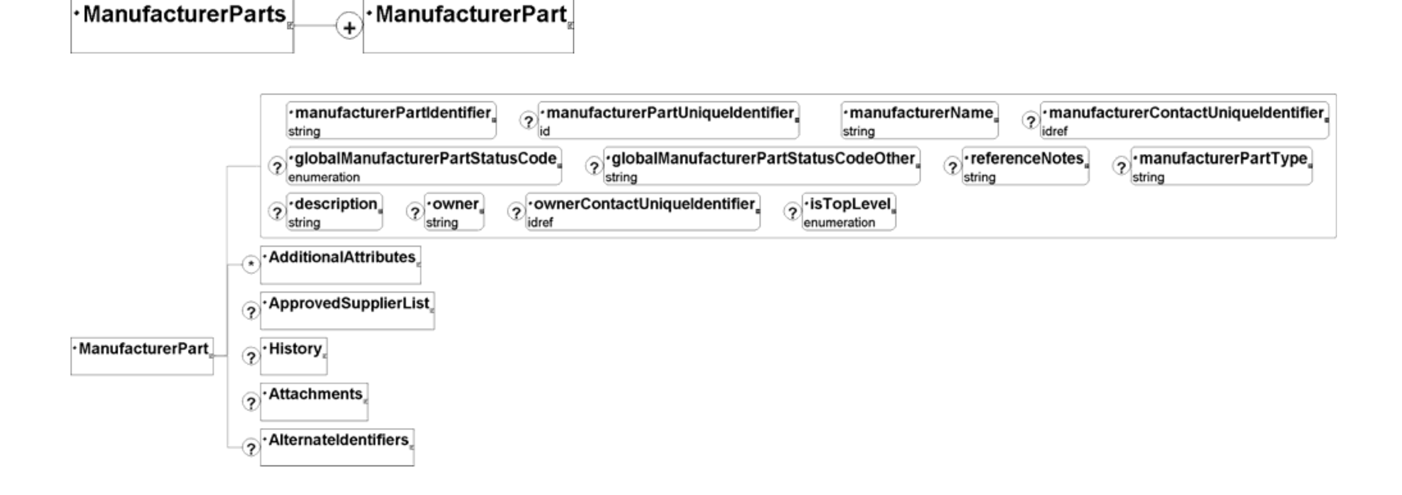
4.3 Additional Attributes (see 10.1)



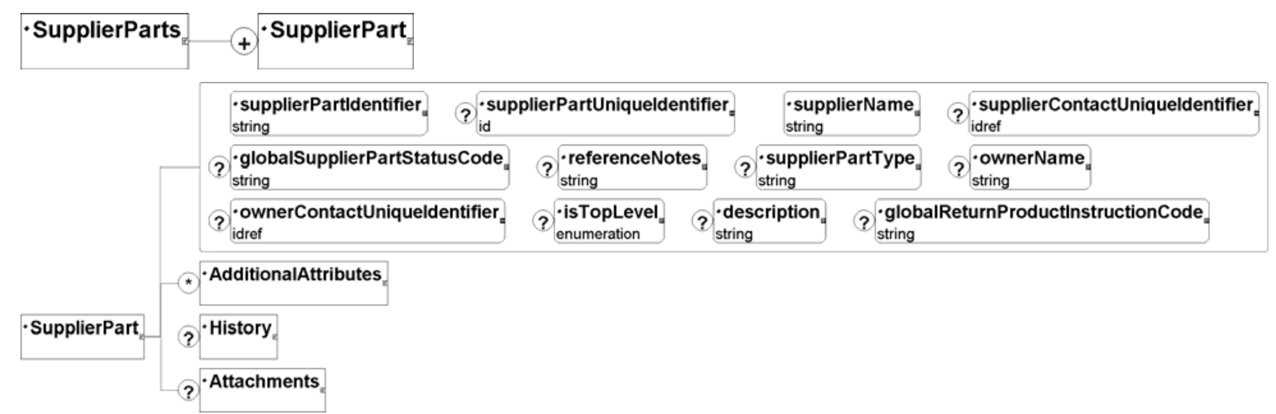
4.4 Changes



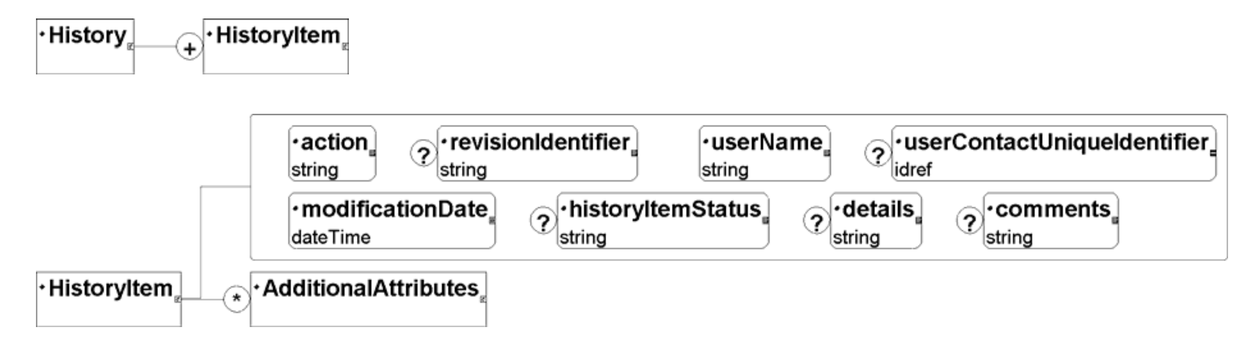
4.5 Manufacturer Parts



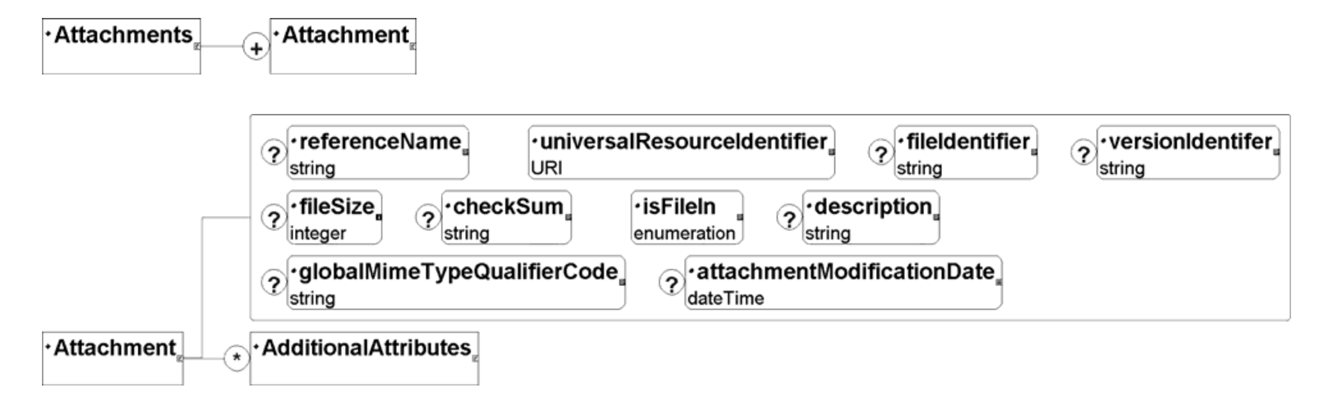
4.6 Supplier Parts



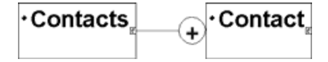
4.7 History (see 7.1)

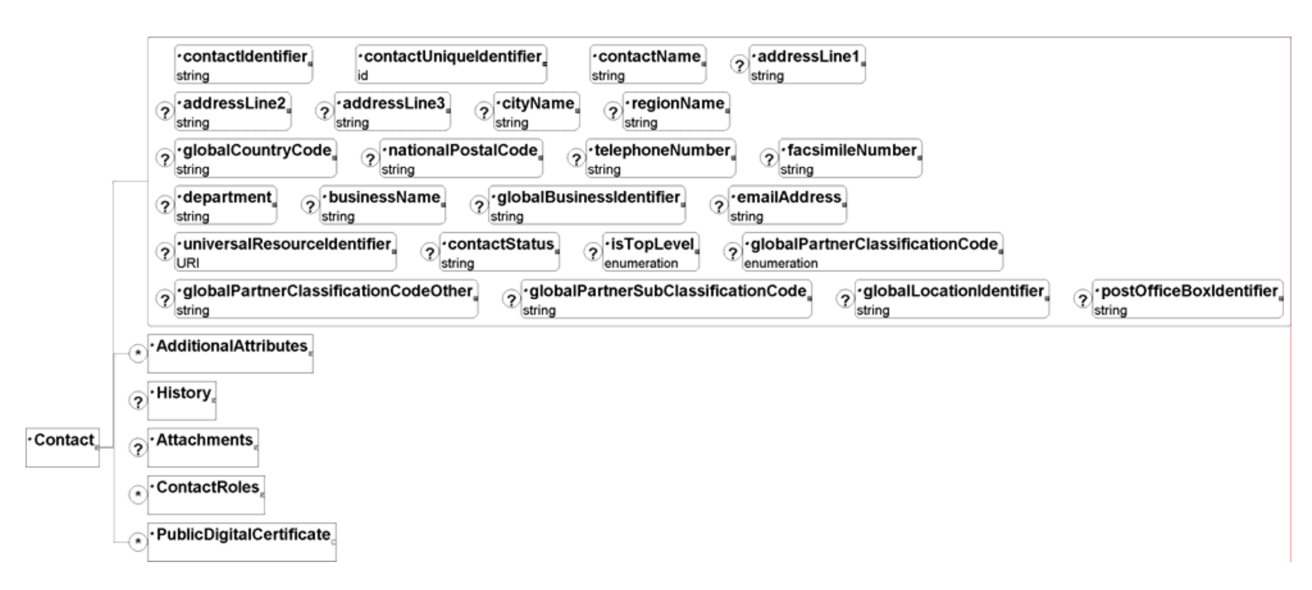


4.8 Attachments (see 8.1)

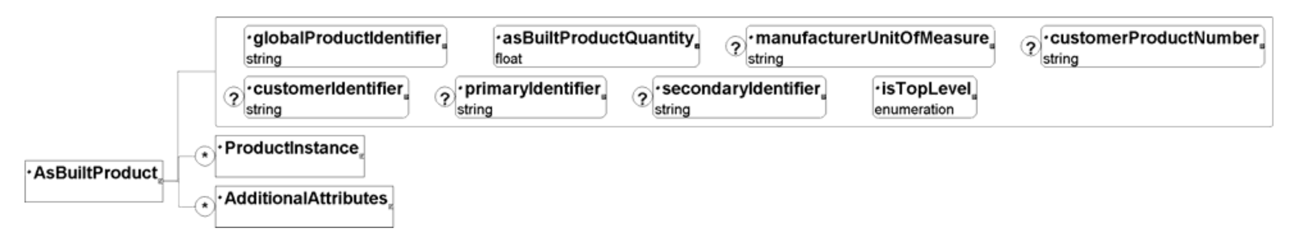


4.9 Contact (see 9.1)

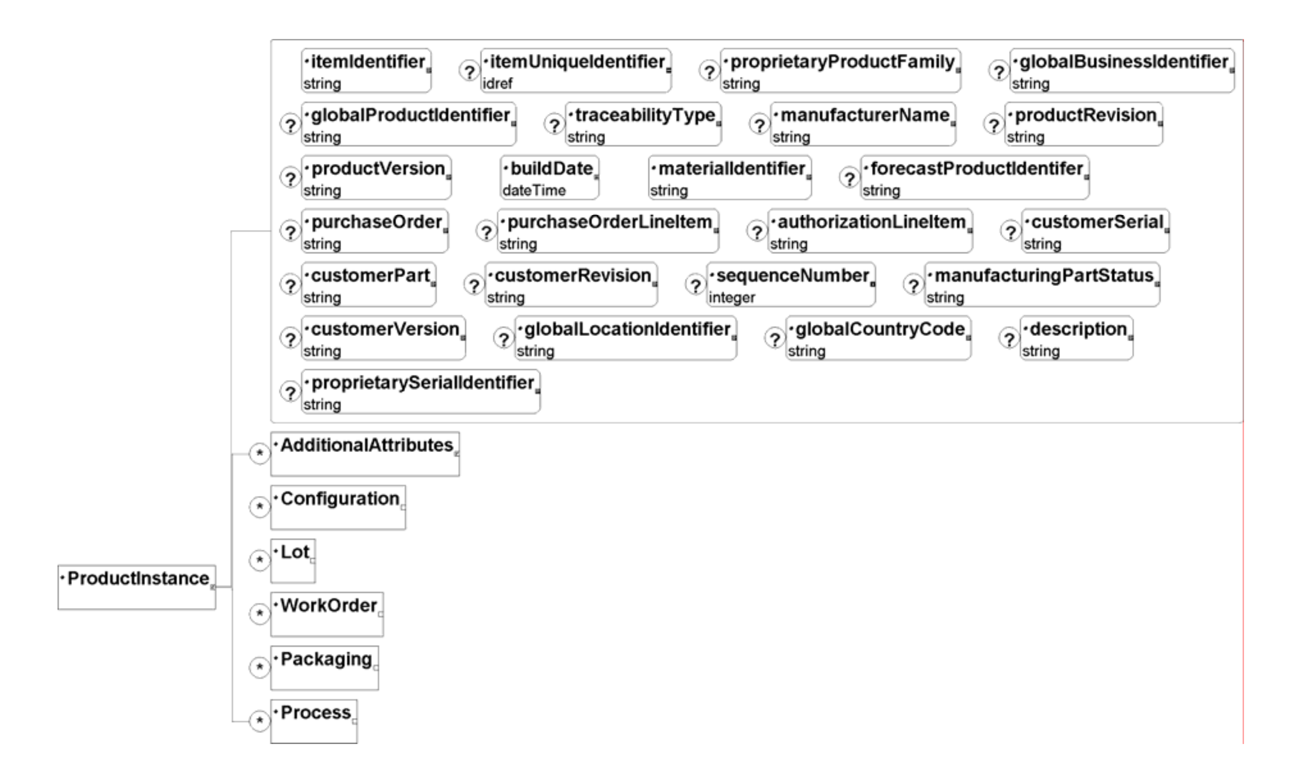




4.10 AsBuilt Product



4.11 Product Instance



5 Recommended Implementation Practices

5.1 Inclusion of Linked Objects

In order to fully understand ID and IDREF, please refer to the XML W3C standard. These are values that are unique to the individual PDX package. You may view them as virtual flat file pointers. ID and IDREF have no value outside of the PDX package.

Objects are often linked to other objects by referring to them. For example, the manufacturerContactUniqueIdentifier refers to a contactUniqueIdentifier by use of IDREF and ID respectfully. The attributes used to link objects are of type IDREF and are defined in the Product Data eXchange diagram. The ID field is not optional and must always be populated to define the ID of the referred object. Every IDREF must have a corresponding ID entry.

Contact information exchanged within this standard is different than the contact information found in RosettaNet headers in that the information concerns a role of engineering manager, purchasing manager, test engineer, etc. and not to the IT contact person that is referenced in RosettaNet headers for the purpose of delivery and receipt of transactions. This technique can also be used to send an entire contact list with referential information on all contacts between trading partners in bulk and then agreeing upon referential cross identification of roles and responsibilities and any required or optional approval or alternate approval contact information. The requirements of approval's and tracking is in the workflow layer and therefore beyond the scope of this standard and should be addressed in either a transport standard such as RosettaNet or OAG, or in the implementation workflow by the solution provider, or by the trading partners through mutual agreement of management of the information exchanged in the workflow layer in implementing the IPC257x standard. However, there are available optional attributes that assist the workflow layer.

5.2 Attachments

The Product Data eXchange package may include attachments that are necessary as part of the product content. These may be any kind of file including a Universal Resource Identifier (URI) reference, other XML/DTD documents, corresponding XSL files, drawings, Gerber files, test specifications, etc. Attachments may be handled in the following ways:

- Included in the package – The attachment is included as part of the Product Data eXchange package and is delivered with the package. The “isFileIn” attribute is set to “yes” to indicate that the product data includes an attachment referenced via a URI. This requires careful communication as the contents of a URI are not managed as part of the package and can change independently. The “isFileIn” attribute is set to “no” to indicate that the product data references an attachment, but the attachment is not included as part of the package.

- Referenced via FileName – The metadata, including the FileName that is associated with the attachment is included, but the attachment itself is not included. The “isFileIn” attribute is set to “no” to indicate that the product data includes an attachment, but the attachment is not included as part of the PDX package. One use of this feature is when the sender knows the recipient already has the attachment and does not wish to resend it.

- Excluded from the package – The attachment can be excluded from the package entirely by giving no reference to the attachment in the package.

5.3 Missing Required Attributes

If the data source used to generate a Product Data eXchange package does not have a value for a required attribute, the value of the attribute should be set to "" so that the package won't be rejected by an application using a validating XML parser.

It is recommended that workflow rules be established such that error level checking is enabled for various levels, such as: critical, required, suggested, split, optional, obsolete, isolate – do not use category. The resulting communication should be one of logging, alerts, escalation, tracking and resolution. It is encouraged that the use of roles within the contact element should be defined between partners in facilitating this communication within the workflow layer but is beyond the scope of this standard.

5.4 Avoid Data Duplication in Product Data eXchange Package

If a Product Data eXchange package has two objects that share a sub-assembly or an item, the shared data (both meta data and possible attachment files associated with them) should not be duplicated in the package. For example, in figure 3, object A and P share the sub-assembly C. When a Product Data eXchange package contains both object A and P, the data of the C assembly should be included in the package only once. It must be noted that any change in any underlying part or assembly requires a change in the levels above so as to keep each level unique for clarification in manufacturing. It may, however, be agreed within the supply chain trading partners the level above is not materially affected from a business or engineering reason and therefore may not need to be changed. However, this is discouraged in use so that a complete audit trail for warranty entitlement can be maintained.

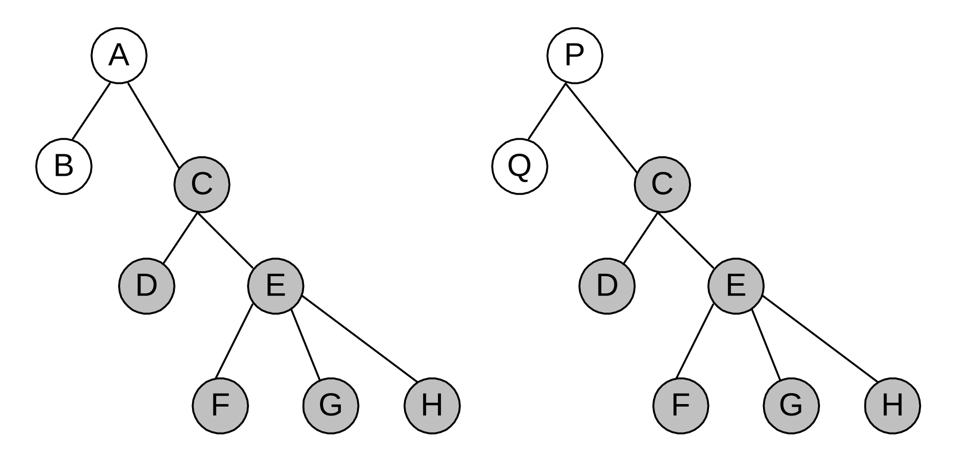


Figure 3 Assembly Hierarchy

This consideration led to the important design decision to define Item in a flat structure instead of an embedded or recursive structure. Doing so makes it possible to include just one instance for multiple presences of a given object in a PDX package; the instance would then be referenced in multiple places.

The avoidance of data duplication is a recommended practice, which the Product Data eXchange standard does not enforce, and transmitting data duplication in a Product Data eXchange package does not constitute a violation of the standard. There are standard practices within government or industry groups that require a complete "line by line" transmittal of information, which would require data duplication in lower subsections of the BOM. Therefore, the standard does not prohibit the practice of sending a fully duplicated subsection of the BOM for adherence to established practices.

It should be noted that the package could be used to transmit complete contact information without other information. The same is true of a complete BOM with partial buyer required elements for RFQ submittals. AML vendors database information can be transmitted in bulk form also. This allows the loading of catalogue information in bulk for components and their suppliers. It is up to the particular application to make use of cross-reference information capabilities that are available in IPC257x series. The AdditionalAttributes element can be used to transmit additional purchasing information including pricing which is beyond the scope of this standard but allows this standard to be used in RFQ and Quote Response scenarios.

By sending bulk load information separate, only updated or changed – delta – information need to be transmitted unless an error is encountered.

5.5 Excluding data from the Product Data eXchange package

The Product Data eXchange standard supports the ability to send incremental change data or subsections of the element tree, rather then replicate data supporting an entire BOM with every Product Data eXchange package sent.

For example, when an ECO is sent for a particular product, it is unnecessary to send the entire Product Data eXchange file to the agency responsible for implementing the ECO if it is known that the agency has the data loaded into their system. It would only be necessary to send the changes to the Product Data eXchange document.

If data is excluded from a Product Data eXchange package, the sender should verify that the pruned Product Data eXchange package can stand-alone and be understood by the recipient. For example, BOM subsets/subtrees, BOM mark-ups, or AML mark-ups may be sent without all related data included. The sender should ensure that the Product Data eXchange package contains enough information to identify the change being communicated and its association with all other effected elements.

In particular, BOM changes, AML changes, schematic changes (attachments), and other attachments should all be linked and identified with each other, and be tagged with ECO identification specified by the Product Data eXchange standard. Sub-assemblies within a BOM should be able to be transmitted to recipients without needing to send the entire BOM. For example, a product sub-assembly is to be contracted to a particular Electronics Manufacturing Services provider, which doesn't need the entire BOM. The Electronics Manufacturing Services provider may be involved in manufacturing several subtrees of the BOM at various levels, and the standard can be used to transmit the appropriate BOM subtrees without needing to transmit the entire BOM, for a more efficient transmission. This is particularly needed when the Product Data eXchange goes back and forth due to negotiation between the originator of the design and the manufacturer of some of the sub-assemblies. Any process that is lengthy and unwieldy will result in an impediment to the process of converging on an agreed upon solution.

However, best practices should require a fresh resend of the complete BOM subsection or other subsection information upon error in processing an incremental change with alert notification of all trading partners involved. A more sophisticated and elegant solution would be to have systems resend and compare information higher up in the BOM tree structure or other tree structure until successful synchronization of the database occurs without the need of human intervention or escalation unless directed in the workflow layer. It is not a violation of this standard for a complete database or subsection database "refresh" to be transacted on each change or at predetermined intervals if the trading partners so agree. The PDX standard provides content definition. The implementation of the workflow process is beyond the scope of this standard and is left to other standard bodies, implementers and solution providers, which deal specifically with the workflow layer of implementation.

5.6 Format of Date/Time Fields

The recommended format for date/time data is a string containing W3C datetime format of the current date and time. (See http://www.w3.org/TR/NOTE-datetime-970915.html). The following formats from the W3C specification are allowed:

Complete date: YYYY-MM-DD (eg 1997-07-16)

Complete date plus hours and minutes: YYYY-MM-DDThh:mm TZD (eg :1997-07-16T19:20+01:00)

Complete date plus hours, minutes, and seconds: YYYY-MM-DDThh:mm:ssTZD
(eg: 1997-07-16T19:20:30+01:00)

Complete date plus hours, minutes, seconds and a decimal fraction of a Second
YYYY-MM-DDThh:mm:ss.sTZD(e.g. 1997-07-16T19:20:30.45+01:00)

Where:

YYYY = four-digit year

MM = two-digit month (01=January, etc.)

DD = two-digit day of month (01 through 31)

hh = two digits of hour (00 through 23) (am/pm NOT allowed)

mm = two digits of minute (00 through 59)

ss = two digits of second (00 through 59)

s = one or more digits representing a decimal fraction of a second

TZD = time zone designator (Z or +hh:mm or -hh:mm)

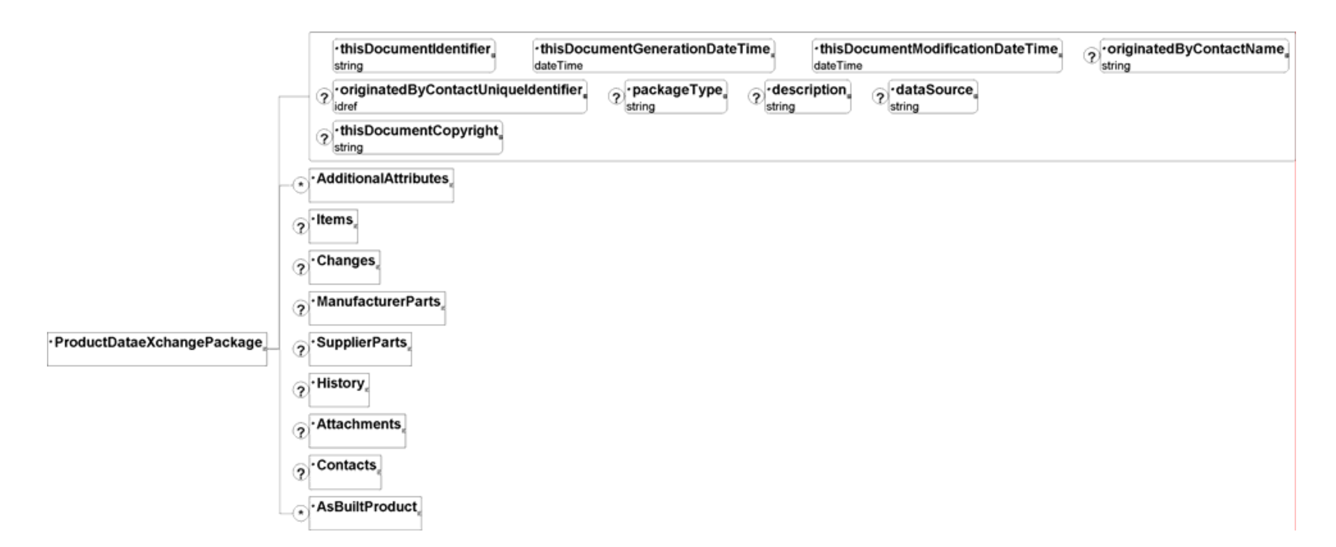
Since all the attributes in Product Data eXchange are defined as character strings due to constraints of XML DTD, the above recommended date/time formats cannot be enforced by the current version of the Product Data eXchange standard. It is up to Product Data eXchange package generating applications to voluntarily adhere to these recommendations. In suggested best practices, the diagrams illustrate strong data typing associated with Schema Development as do the included tables.

5.7 isTopLevel Attribute

The isTopLevel attribute is used to indicate how an object (of type item, ManufacturerPart, or SupplierPart) fits into a Product Data eXchange package. The isTopLevel attribute provides Product Data eXchange parsers an efficient mechanism to identify the top-level item of an assembly.

6 ProductDataeXchangePackage

The ProductDataeXchangePackage element is required for every Product Data eXchange file. It is the root element of a Product Data eXchange transmission and describes the package as well as all the data within the package. There can be only one ProductDataeXchangePackage element in each ProductDataeXchange package.

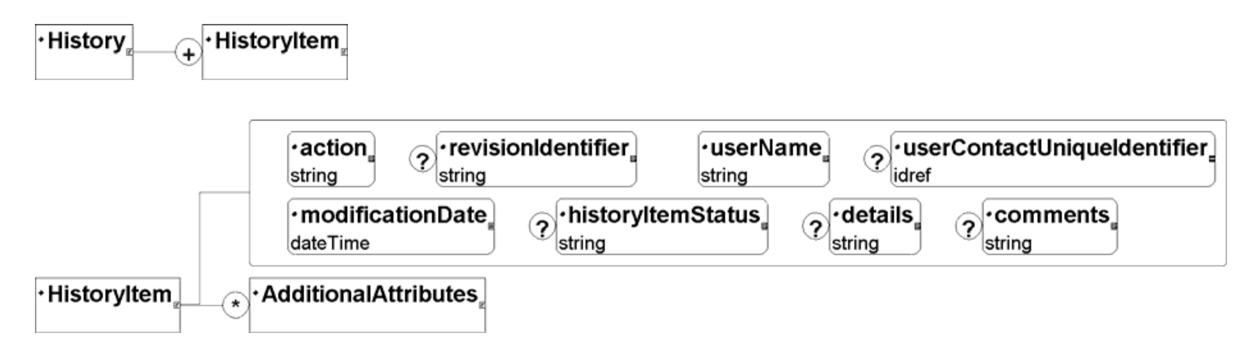


Attribute Name	Type	Required?	Description
thisDocumentIdentifier	CDATA	#REQUIRED	ID for a package. It is recommended that it is universally unique. There is no format defined for it. Any algorithm generating such an id can be used.
thisDocumentGenerationDateTime	CDATA	#REQUIRED	The date and time when the package was generated. Refer to section 5.6 for suggested formats.
thisDocumentModificationDateTime	CDATA	#REQUIRED	Date and time when the package was last modified. Refer to section 5.6 for suggested formats.
originatedByContactName	CDATA	#IMPLIED	Originator of the package
originatedByContactUniqueIdentifier	IDREF	#IMPLIED	Originator’s contact element
packageType	CDATA	#IMPLIED	Type of package. It is recommended values: Manufacture | ChangeRequest | ChangeOrder | ChangeNotification | Test | Kit | BuildReport
description	CDATA	#IMPLIED	Description of the package
dataSource	CDATA	#IMPLIED	Source of the package
thisDocumentCopyright	CDATA	#IMPLIED	Copyright information of the package

7 History

The history element holds a collection of HistoryItem elements that together describe the entire history of the related object.

7.1 HistoryItem



The HistoryItem element describes a specific historic action.

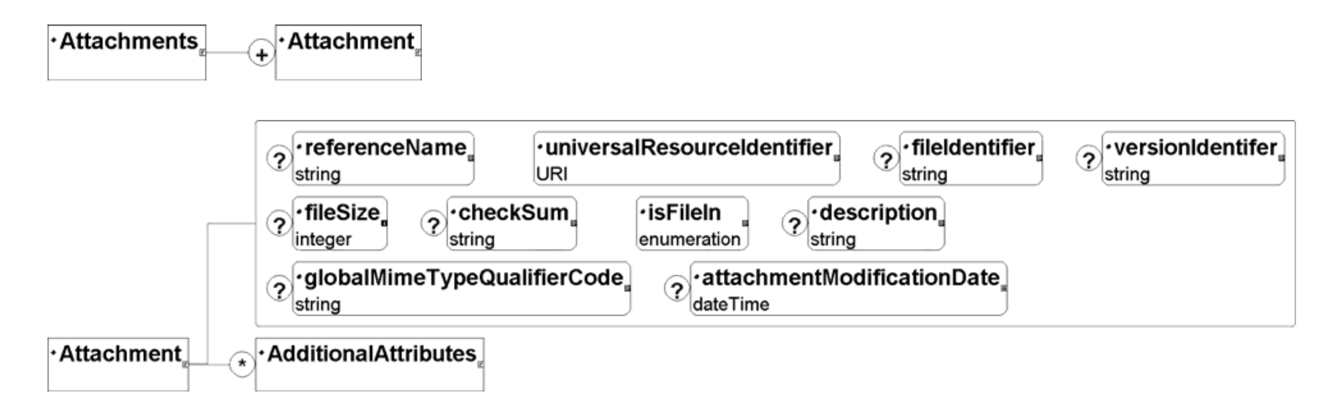
Attribute Name	Type	Required?	Description
action	CDATA	#REQUIRED	Action taken on the object (Add, Modify, Delete, etc.)
revisionIdentifier	CDATA	#IMPLIED	Revision number
userName	CDATA	#REQUIRED	Originator of package instance
userContactUniqueIdentifier	IDREF	#IMPLIED	Originator's ContactID referencing Contact element
modificationDate	CDATA	#REQUIRED	Date and time of the action
historyItemStatus	CDATA	#IMPLIED	Status of the object
details	CDATA	#IMPLIED	Specific details related to the action taken.
comments	CDATA	#IMPLIED	Free-form comments for this event. These are general comments on the action.

8 Attachments

The attachments element contains all the attachment elements associated with a specific object.

8.1 Attachment

The attachment element is a pointer to a file either through a URL or within the Product Data eXchange zip file. If the file is zipped and included in the Product Data eXchange package, the FileName contains the name of the file. Otherwise, the full URL of the file location is contained in the FileName. There is one attachment element for each attachment associated with an object.



Attribute Name	Type	Required?	Description
referenceName	CDATA	#IMPLIED	User specified file name (eg: file.doc)
universalResourceIdentifier	URI	#REQUIRED	A network-centric identifier that provides the fully attributed identity of a resource. Refer to IETF RFC 2396 for further definition. If referring to a file contained in the PDX package, use the file://filename notation.
fileIdentifier	CDATA	#IMPLIED	Unique identifier for the file; may be a key to the file. This field may be used when several attached files have the same filename.
versionIdentifier	CDATA	#IMPLIED	Version of the file
fileSize	CDATA	#IMPLIED	File size
checkSum	CDATA	#IMPLIED	MD5 message digest algorithm, RFC 1321 (FTP://NIS.NSF.NET/internet/documents/rfc)
isFileIn	Yes | No	#REQUIRED	Flag to indicate if file is included in Product Data eXchange package.
description	CDATA	#IMPLIED	File description
globalMimeTypeQualiferCode	CDATA	#IMPLIED	The MIME type. Refer to http://www.iana.org for a list of types.
attachmentModificationDate	CDATA	#IMPLIED	Datetime stamp of file

9 Contacts

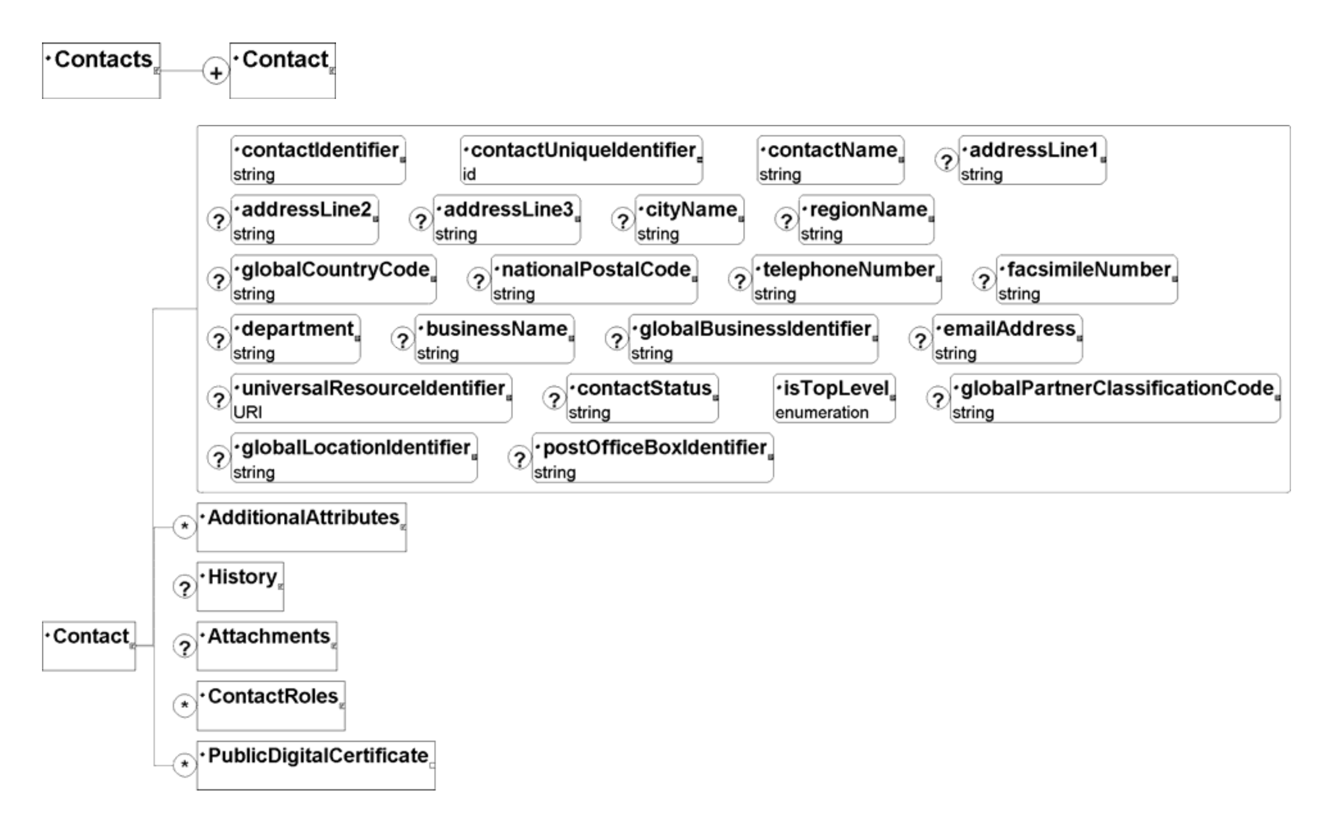
The contacts element is used to hold a collection of contact elements.

9.1 Contact

Each contact represents an individual or entity. The main differentiating factor between the RosettaNet RNIF 1.x or 2.0 contact field and the PDX element is that the contact information within this standard assigns additional roles (beyond information technology). For example, trading partners that wish to effect a Engineering Change Order (ECO) have different persons within their company who are responsible for reviewing the ECO and agreeing to implementation or “cut in” date, and reviewing the proposed changes as it may effect purchasing, test engineering, production, etc. Therefore, a contact may have the role of Engineering Manager whose digital signature is determined to be required for approval of the ECO.

Although the workflow of ECO’s is beyond the scope of this standard, it is anticipated that implementers will use the role information in order to track the approval process. The Engineering Manager, in the example above, may have alternate people who can “signoff” on the approval in his/her absence. In such an instance, the isAlternate attribute of the GroupRole entity would be set to “yes” for the role of Engineering Manager. A person can occupy more than one role. Furthering the example, the Test Engineering Manager may have “veto” power on an EC through his/her role as Test Engineering Manager but is not required to sign. The Engineering Test Manager could also be the alternate signoff designee for the Engineering Manager role that has a requirement for approval before an ECO can be implemented.

The PublicDigitalCertificate (optional) can have multiple entries that can be used in the “signoff” process. Multiple digital certificates are available due to a person possibly using two or more different certificates, one from each trading partner involved.

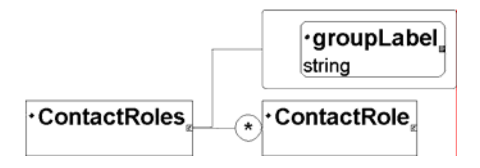


Attribute Name	Type	Required?	Description
contactIdentifier	CDATA	#REQUIRED	contact id
contactUniqueIdentifier	ID	#REQUIRED	Unique Pointer for referencing this contact
contactName	CDATA	#REQUIRED	Name of the contact person(s) within the organization
addressLine1	CDATA	#IMPLIED	The first line of a physical address
addressLine2	CDATA	#IMPLIED	The second line of a physical address
addressLine3	CDATA	#IMPLIED	The third line of a physical address
cityName	CDATA	#IMPLIED	The name of a City
regionName	CDATA	#IMPLIED	The name of a province or state within a country
globalCountryCode	CDATA	#IMPLIED	Code identifying the two character country code specified in ISO 3166-1993
nationalPostalCode	CDATA	#IMPLIED	Code identifying geographic location as specified by a national postal code
telephoneNumber	CDATA	#IMPLIED	The numeric schema designed to achieve contact via telephone
facsimileNumber	CDATA	#IMPLIED	The numeric schema design to achieve contact via facsimile
department	CDATA	#IMPLIED	Department or Mail Stop
businessName	CDATA	#IMPLIED	The name of a business entity
globalBusinessIdentifier	CDATA	#IMPLIED	A unique business identifier (DUNS).

Attribute Name	Type	Required?	Description
emailAddress	CDATA	#IMPLIED	email address
universalResourceIdentifier	CDATA	#IMPLIED	Company's URI
contactStatus	CDATA	#IMPLIED	Status – suggest use "active", "alternate", "inactive", etc.
isTopLevel	(Yes | No)	#IMPLIED	Set to yes if the contact is at the top level of the PDX package. Set to no if the contact is an element of another object. (Default is No)
globalPartnerClassification Code	(Carrier | Distributor | EndUser | EndUserGovernment | Financier | Manufacturer | Retailer | Shopper | FreightForwarder | Broker | CustomsBroker | Warehouser | DistributionCenter | ContractManufacturer | Reseller | OriginalEquipmentManufacturer | Other)	#IMPLIED	Code identifying a partner's function in the supply chain. Default is Unspecified
globalPartnerClassification CodeOther	CDATA	#IMPLIED	If the above globalPartnerClassificationCode attribute is set to "Other", use this attribute to provide a more descriptive value. If the above globalPartnerClassificationCode is NOT set to "Other", LEAVE THIS FIELD BLANK.
globalPartnerSubClassifica tionCode	CDATA	#IMPLIED	Code further identifying a partner's function in the supply chain.
globalLocationIdentifier	CDATA	#IMPLIED	Location uniquely identified by the DUNS +4 number.
postOfficeBoxIdentifier	CDATA	#IMPLIED	The proprietary identity of a physical address, located at a post office, designed solely to accept or receive mail.

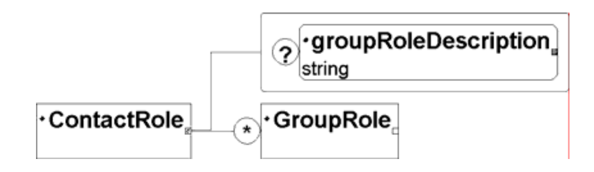
9.2 ContactRoles

ContactRoles allow an implementer of this standard to assign multiple roles to indviduals. The groupLabel attribute could contain the project name, division, or other designator. The groupLabel is coupled with zero or more ContactRole attributes. The groupRoleDescription may contain descriptions such as Engineering, Purchasing or other descriptions which may be applicable between the trading partners. The isAlternate element allows for others being able to “signoff” within the approval process.



Attribute Name	Type	Required?	Description
groupLabel	CDATA	#REQUIRED	Label for the grouping of roles

9.2.1 ContactRole



Attribute Name	Type	Required?	Description
groupRoleDescription	CDATA	#IMPLIED	Optional description or may be used to further subdivide grouping classifications

9.2.2 GroupRole



Attribute Name	Type	Required?	Description
role	CDATA	#REQUIRED	Agreed upon role classification between trading partners
isAlternate	(Yes | No)	#REQUIRED	Represents whether this contact is an alternate approval/disapproval role. For the primary role responsibility, this value should be set to No.
description	CDATA	#IMPLIED	Description of the role

9.3 PublicDigitalCertificate

A digital certificate may be used to encrypt an attachment, for non-repudiation of approval/disapproval, and allows embedding of security within the PDX package exchange.



Attribute Name	Type	Required?	Description
publicDigitalCertificate	CDATA	#REQUIRED	Public digital certificate
trustedRoot	CDATA	#IMPLIED	Name of the issuer of the certificate
trustedRootURI	CDATA	#IMPLIED	The URI of the issuer of the certificate for verification and valadation of the certificate.

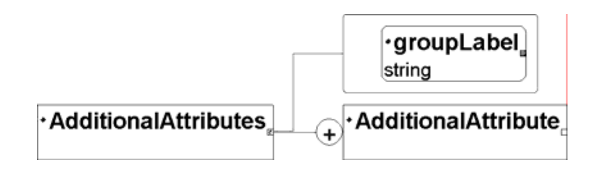
10 AdditionalAttributes

PDX was engineered with the understanding that it is unrealistic to expect a standard to meet every organization’s needs, especially as those needs change with time. For that reason, the AdditionalAttributes and AdditionalAttribute elements are included in the standard to allow user-defined extensions to any Product Data eXchange entity. The AdditionalAttribute element defines a single new attribute; AdditionalAttributes enables the grouping of these new attributes.

Note that the use of these elements in effect creates a custom version of the standard, and extensions defined in this manner will not interoperate with standard Product Data eXchange implementations. For this reason, users are encouraged to use expansion mechanisms judiciously, and to recommend any desired additions to the IPC Product Data eXchange committee.

Item characteristics such as package, resistance, etc. attributes are not to be handled by AdditionalAttributes, but are to be handled by the characteristics element defined in IPC 2578.

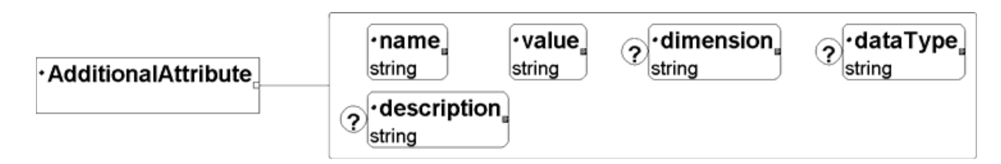
All entities may have zero or more child AdditionalAttribute elements. The AdditionalAttributes element is a collection of AdditionalAttribute elements.



Attribute Name	Type	Required?	Description
groupLabel	CDATA	#REQUIRED	Label for a group of grouped additional attributes

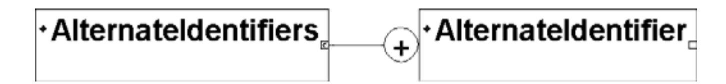
10.1 AdditionalAttribute

Each AdditionalAttribute element represents a non-standard, user-defined attribute.



Attribute Name	Type	Required?	Description
name	CDATA	#REQUIRED	The attribute name
value	CDATA	#REQUIRED	The attribute value
dimension	CDATA	#IMPLIED	The dimension (units) of the value.
dataType	(String | Boolean | Float | Double | Decimal | DateTime | Binary | UriReference | Other)	#IMPLIED	The data type of the value
dataTypeOther	CDATA	#IMPLIED	If the above dataTypeCode attribute is set to “Other”, use this attribute to provide a more descriptive value. If the above dataTypeCode is NOT set to “Other”, LEAVE THIS FIELD BLANK.
description	CDATA	#IMPLIED	Description of the attribute

11 AlternateIdentifiers



The AlternateIdentifiers element holds a collection of AlternateIdentifier elements that provide an optional, alternative mechanism for referring to an item or part.

11.1 AlternateIdentifier



The AlternateIdentifier element allows for the modeling of an item that maps to more than one part number (itemIdentifier). This is necessary for supporting businesses, who through acquisitions or industry requirements, have identical items represented by more than one part number (itemIdentifier). A description is used to support classification of the alternate identifying number.

Attribute Name	Type	Required?	Description
alternateIdentifierNumber	CDATA	#REQUIRED	The identifying number.
description	CDATA	#REQUIRED	The description of the numbering scheme from which the alternateIdentifierNumber is derived.

12 Document Type Definition (DTD)

This specification uses a DTD instead of XML Schemas because, at the time of this writing, the XML Schema specification was not completely defined. It is expected that a future version of Product Data eXchange XML definitions will be written in XML Schema.

The following is a master DTD that includes all elements from the IPC-2571, IPC-2576 and IPC-2578.

```
<?xml version='1.0' encoding='UTF-8' ?>

<!ELEMENT AdditionalAttribute EMPTY>

<!ATTLIST AdditionalAttribute  name         CDATA  #REQUIRED
                         value        CDATA  #REQUIRED
                         dimension     CDATA  #IMPLIED
                         dataType      (String |
                                  Boolean |
                                  Float |
                                  Double |
                                  Decimal |
                                  DateTime |
                                  Binary |
                                  UriReference |
                                  Other )  #IMPLIED
                          dataTypeOther CDATA  #IMPLIED
                          description   CDATA  #IMPLIED >
<!ELEMENT AdditionalAttributes (AdditionalAttribute+)>

<!ATTLIST AdditionalAttributes  groupLabel CDATA  #REQUIRED >
<!ELEMENT AffectedItems (AffectedItem+)>

<!ELEMENT AffectedItem (AdditionalAttributes* , BillOfMaterialMarkups? , ApprovedManufacturerListMarkups? , AttachmentMarkups?)>

<!ATTLIST AffectedItem  itemIdentifier              CDATA  #REQUIRED
                  itemUniqueIdentifier         IDREF  #IMPLIED
                  manufacturingSite            CDATA  #IMPLIED
                  oldRevision                  CDATA  #IMPLIED
                  newRevision                  CDATA  #REQUIRED
                  obsoleteDate                 CDATA  #REQUIRED
                  effectiveDate                CDATA  #REQUIRED
                  disposition                  CDATA  #IMPLIED
                  globalLifeCyclePhaseCode       (Design |
                                  Preliminary |
                                  Prototype |
                                  Pilot |
                                  Conditional |
                                  Production |
                                  Pending |
                                  Inactive |
                                  Unqualified |
                                  Disqualified |
                                  Obsolete |
                                  Other )  #IMPLIED
                  globalLifeCyclePhaseCodeOther CDATA  #IMPLIED
                  description                  CDATA  #IMPLIED >
<!ELEMENT AlternateItems (AlternateItem+)>

<!ELEMENT AlternateItem (AdditionalAttributes*)>

<!ATTLIST AlternateItem  itemIdentifier           CDATA  #IMPLIED
                   itemUniqueIdentifier      IDREF  #REQUIRED
                   globalPreferredStatusCode CDATA  #IMPLIED >
<!ELEMENT ApprovedManufacturerListItem (AdditionalAttributes* , AlternateIdentifiers?)>

<!ATTLIST ApprovedManufacturerListItem  manufacturerPartIdentifier           CDATA  #REQUIRED
                              manufacturerPartUniqueIdentifier      IDREF  #IMPLIED
```

```
                    manufacturerContactUniqueIdentifier   IDREF  #IMPLIED
                    globalManufacturerPartStatusCode      (Approved |
                                                           QualityHold |
                                                           UnderQualification |
                                                           Unqualified |
                                                           Disqualified |
                                                           Obsolete |
                                                           Nonpreferred |
                                                           Conditional |
                                                           Reference |
                                                           Other )  #IMPLIED
                    globalManufacturerPartStatusCodeOther CDATA  #IMPLIED
                    globalPreferredStatusCode            CDATA  #IMPLIED
                    description                   CDATA  #IMPLIED
                    manufacturedBy                    CDATA  #IMPLIED >
<!ELEMENT ApprovedManufacturerListMarkups (ApprovedManufacturerListMarkup+)>

<!ELEMENT ApprovedManufacturerListMarkup (ApprovedManufacturerListMarkupRowOld? ,
ApprovedManufacturerListMarkupRowNew?)>

<!ATTLIST ApprovedManufacturerListMarkup  globalMarkupTypeCode  (Add |
                                              Modify |
                                              Delete |
                                              NoChange )  #REQUIRED >
<!ELEMENT ApprovedManufacturerList (ApprovedManufacturerListItem+)>

<!ELEMENT ApprovedManufacturerListMarkupRowNew (ApprovedManufacturerListItem)>

<!ELEMENT ApprovedManufacturerListMarkupRowOld (ApprovedManufacturerListItem)>

<!ELEMENT Attachments (Attachment+)>

<!ELEMENT Attachment (AdditionalAttributes*)>

<!ATTLIST Attachment  referenceName             CDATA  #IMPLIED
           universalResourceIdentifier CDATA  #REQUIRED
           fileIdentifier            CDATA  #IMPLIED
           versionIdentifer          CDATA  #IMPLIED
           fileSize                  CDATA  #IMPLIED
           checkSum                  CDATA  #IMPLIED
           isFileIn                  (Yes | No )  #IMPLIED
           description               CDATA  #IMPLIED
           globalMimeTypeQualifierCode CDATA  #IMPLIED
           attachmentModificationDate  CDATA  #IMPLIED >
<!ELEMENT AttachmentMarkups (AttachmentMarkup+)>

<!ELEMENT AttachmentMarkup (AttachmentMarkupRowOld? , AttachmentMarkupRowNew?)>

<!ATTLIST AttachmentMarkup  globalMarkupTypeCode  (Add | Modify | Delete | NoChange )  #REQUIRED >
<!ELEMENT AttachmentMarkupRowNew (Attachment)>

<!ELEMENT AttachmentMarkupRowOld (Attachment)>

<!ELEMENT ApprovedSupplierList (ApprovedSupplierListItem+)>

<!ELEMENT ApprovedSupplierListItem (AdditionalAttributes* , AlternateIdentifiers?)>

<!ATTLIST ApprovedSupplierListItem  supplierPartIdentifier            CDATA  #REQUIRED
                  supplierPartUniqueIdentifier       ID     #IMPLIED
                  supplierPartContactUniqueIdentifier IDREF  #IMPLIED
                  globalSupplierPartStatusCode       CDATA  #IMPLIED
                  comments                         CDATA  #IMPLIED
                  suppliedBy                       CDATA  #IMPLIED >
<!ELEMENT BillOfMaterial (BillOfMaterialItem+)>

<!ELEMENT BillOfMaterialItem (AdditionalAttributes* , ReferenceDesignators? , AlternateItems? , SerialNumbers?)>

<!ATTLIST BillOfMaterialItem  revisionIdentifier               CDATA  #IMPLIED
              isSerializationRequired          (Yes | No )  #IMPLIED
              globalBillOfMaterialTypeCode       (DirectMaterial |
```

```
                                    IndirectMaterial |
                                    Subassembly |
                                    PhantomSubassembly |
                                    EndProduct |
                                    Kit |
                                    Setup |
                                    AsNeeded |
                                    Reference |
                                    Nontangible |
                                    Other )  #IMPLIED
                 globalBillOfMaterialTypeCodeOther  CDATA  #IMPLIED
                 notes                      CDATA  #IMPLIED
                 billOfMaterialItemIdentifier       CDATA  #IMPLIED
                 billOfMaterialItemUniqueIdentifier IDREF  #IMPLIED
                 itemQuantity                       CDATA  #IMPLIED
                 globalProductQuantityTypeCode      (PerAssembly |
                                    PerSetup |
                                    AsNeeded |
                                    Shrinkage |
                                    Other )  #IMPLIED
                 globalProductQuantityTypeCodeOther CDATA  #IMPLIED
                 description                CDATA  #IMPLIED
                 proprietarySequenceIdentifier      CDATA  #IMPLIED >
<!ELEMENT BillOfMaterialMarkups (BillOfMaterialMarkup+)>

<!ELEMENT BillOfMaterialMarkup (BillOfMaterialMarkupRowOld? , BillOfMaterialMarkupRowNew?)>

<!ATTLIST BillOfMaterialMarkup  globalMarkupTypeCode  (Add |
                              Modify |
                              Delete |
                              NoChange )  #REQUIRED >
<!ELEMENT BillOfMaterialMarkupRowNew (BillOfMaterialItem)>

<!ELEMENT BillOfMaterialMarkupRowOld (BillOfMaterialItem)>

<!ELEMENT Changes (Change+)>

<!ELEMENT Change (AdditionalAttributes* , History? , Attachments? , Approvers? , AffectedItems?)>

<!ATTLIST Change  changeNumber                     CDATA  #REQUIRED
          revisionIdentifier               CDATA  #IMPLIED
          changeOriginatedByName           CDATA  #IMPLIED
          changeOriginatedByContactUniqueIdentifier IDREF  #IMPLIED
          globalEngineeringChangeStatusCode        (IssueIdentified |
                                 ChangeRequested |
                                 UnderInvestigation |
                                 ChangeOrderProposed |
                                 ApprovalPending |
                                 OnHold |
                                 Approved |
                                 Cancelled |
                                 Rejected |
                                 Completed |
                                 Released |
                                 Implemented |
                                 Other )  #IMPLIED
          globalEngineeringChangeStatusCodeOther   CDATA  #IMPLIED
          changeStatusDate                 CDATA  #IMPLIED
          changeType                       CDATA  #IMPLIED
          changeSubType                    CDATA  #IMPLIED
          changeOriginationDate            CDATA  #IMPLIED
          requestReason                    CDATA  #IMPLIED
          changeReason                     CDATA  #IMPLIED
          workflow                         CDATA  #IMPLIED
          changeRequestDescription         CDATA  #IMPLIED
          changeOwnerName                  CDATA  #IMPLIED
          changeOwnerContactUniqueIdentifier       IDREF  #IMPLIED
          description                      CDATA  #IMPLIED >
<!ELEMENT ChangeHistory (ChangeHistoryItem+)>
```

```
<!ELEMENT ChangeHistoryItem (AdditionalAttributes*)>

<!ATTLIST ChangeHistoryItem  changeNumber                CDATA  #REQUIRED
                       revisionIdentifier          CDATA  #IMPLIED
                       globalLifeCyclePhaseCode        (Design |
                                                Preliminary |
                                                Prototype |
                                                Pilot |
                                                Conditional |
                                                Production |
                                                Pending |
                                                Inactive |
                                                Unqualified |
                                                Disqualified |
                                                Obsolete |
                                                Other )  #IMPLIED
                       globalLifeCyclePhaseCodeOther       CDATA  #IMPLIED
                       releasedDate                CDATA  #IMPLIED
                       incorporatedDate             CDATA  #IMPLIED
                       effectiveDate               CDATA  #IMPLIED
                       obsoleteDate                CDATA  #IMPLIED
                       changeType                  CDATA  #IMPLIED
                       proposedRevision             CDATA  #IMPLIED
                       globalEngineeringChangeStatusCode     (IssueIdentified |
                                                ChangeRequested |
                                                UnderInvestigation |
                                                ChangeOrderProposed |
                                                ApprovalPending |
                                                OnHold |
                                                Approved |
                                                Rejected |
                                                Completed |
                                                Released |
                                                Implemented |
                                                Other )  #IMPLIED
                       globalEngineeringChangeStatusCodeOther CDATA  #IMPLIED
                       description                CDATA  #IMPLIED >
<!ELEMENT Characteristics (MeasuredCharacteristic* , RangedCharacteristic* , EnumeratedCharacteristic* , TextualCharacteristic*)>

<!ATTLIST Characteristics  category CDATA  #REQUIRED >
<!ELEMENT MeasuredCharacteristic EMPTY>

<!ATTLIST MeasuredCharacteristic  definitionSource          CDATA  #IMPLIED
                          measuredCharacteristicName   CDATA  #IMPLIED
                          measuredCharacteristicValue  CDATA  #IMPLIED
                          engineeringUnitOfMeasure     CDATA  #IMPLIED
                          engineeringNegativeTolerance CDATA  #IMPLIED
                          engineeringPositiveTolerance CDATA  #IMPLIED >
<!ELEMENT RangedCharacteristic EMPTY>

<!ATTLIST RangedCharacteristic  definitionSource            CDATA  #IMPLIED
                        rangedCharacteristicName      CDATA  #IMPLIED
                        rangedCharacteristicLowerValue CDATA  #IMPLIED
                        rangedCharacteristicUpperValue CDATA  #IMPLIED
                        engineeringUnitOfMeasure      CDATA  #IMPLIED
                        engineeringNegativeTolerance   CDATA  #IMPLIED
                        engineeringPositiveTolerance   CDATA  #IMPLIED >
<!ELEMENT EnumeratedCharacteristic EMPTY>

<!ATTLIST EnumeratedCharacteristic  definitionSource           CDATA  #IMPLIED
                            enumeratedCharacteristicName  CDATA  #IMPLIED
                            enumeratedCharacteristicValue CDATA  #IMPLIED >
<!ELEMENT TextualCharacteristic EMPTY>

<!ATTLIST TextualCharacteristic  definitionSource         CDATA  #IMPLIED
                         textualCharacteristicName  CDATA  #IMPLIED
                         textualCharacteristicValue CDATA  #IMPLIED >
<!ELEMENT Contacts (Contact+)>

<!ELEMENT Contact (AdditionalAttributes* , History? , Attachments? , ContactRoles* , PublicDigitalCertificate*)>
```

```
<!ATTLIST Contact  contactIdentifier                CDATA  #REQUIRED
            contactUniqueIdentifier          ID     #REQUIRED
            contactName                      CDATA  #REQUIRED
            addressLine1                     CDATA  #IMPLIED
            addressLine2                     CDATA  #IMPLIED
            addressLine3                     CDATA  #IMPLIED
            cityName                         CDATA  #IMPLIED
            regionName                       CDATA  #IMPLIED
            globalCountryCode                CDATA  #IMPLIED
            nationalPostalCode               CDATA  #IMPLIED
            telephoneNumber                  CDATA  #IMPLIED
            facsimileNumber                  CDATA  #IMPLIED
            department                       CDATA  #IMPLIED
            businessName                     CDATA  #IMPLIED
            globalBusinessIdentifier         CDATA  #IMPLIED
            emailAddress                     CDATA  #IMPLIED
            universalResourceIdentifier      CDATA  #IMPLIED
            contactStatus                    CDATA  #IMPLIED
            isTopLevel                       (Yes | No )  #IMPLIED
            globalPartnerClassificationCode       (Carrier |
                                  Distributor |
                                  EndUser |
                                  EndUserGovernment |
                                  Financier |
                                  Manufacturer |
                                  Retailer |
                                  Shopper |
                                  FreightForwarder |
                                  Broker |
                                  CustomsBroker |
                                  Warehouser |
                                  DistributionCenter |
                                  ContractManufacturer |
                                  Reseller |
                                  OriginalEquipmentManufacturer |
                                  Other )  #IMPLIED
            globalPartnerClassificationCodeOther CDATA  #IMPLIED
            globalPartnerSubClassificationCode   CDATA  #IMPLIED
            globalLocationIdentifier         CDATA  #IMPLIED
            postOfficeBoxIdentifier          CDATA  #IMPLIED >
<!ELEMENT History (HistoryItem+)>

<!ELEMENT HistoryItem (AdditionalAttributes*)>

<!ATTLIST HistoryItem  action                  CDATA  #REQUIRED
              revisionIdentifier        CDATA  #IMPLIED
              userName                  CDATA  #REQUIRED
              userContactUniqueIdentifier IDREF  #IMPLIED
              modificationDate          CDATA  #REQUIRED
              historyItemStatus         CDATA  #IMPLIED
              details              CDATA  #IMPLIED
              comments                  CDATA  #IMPLIED >
<!ELEMENT Items (Item+)>

<!ELEMENT Item (AdditionalAttributes* , BillOfMaterial? , ApprovedManufacturerList? , History? , Attachments? , ChangeHistory? ,
Characteristics? , AlternateItems? , SerialNumbers? , AlternateIdentifiers?)>

<!ATTLIST Item  itemIdentifier              CDATA  #REQUIRED
          itemUniqueIdentifier          ID     #REQUIRED
          globalLifeCyclePhaseCode       (Design |
                              Preliminary |
                              Prototype |
                              Pilot |
                              Conditional |
                              Production |
                              Pending |
                              Inactive |
                              Unqualified |
                              Disqualified |
```

```
                                   Obsolete |
                                   Other )  #IMPLIED
          globalLifeCyclePhaseCodeOther  CDATA  #IMPLIED
          globalProductTypeCode         CDATA  #IMPLIED
          itemClassification            CDATA  #IMPLIED
          revisionIdentifier            CDATA  #IMPLIED
          versionIdentifer              CDATA  #IMPLIED
          proprietaryProductFamily      CDATA  #IMPLIED
          category                      CDATA  #IMPLIED
          globalProductUnitOfMeasureCode CDATA  #IMPLIED
          makeBuy                       (Make |
                                   Buy |
                                   Consigned |
                                   VendorManaged |
                                   Subcontracted |
                                   Unspecified |
                                   Other )  #IMPLIED
          makeBuyOther                  CDATA  #IMPLIED
          minimumShippableRevision      CDATA  #IMPLIED
          revisionReleasedDate          CDATA  #IMPLIED
          revisionIncorporatedDate      CDATA  #IMPLIED
          isSerializationRequired       (Yes | No )  #IMPLIED
          isCertificationRequired       (Yes | No )  #IMPLIED
          ownerName                     CDATA  #IMPLIED
          ownerContactUniqueIdentifier   IDREF  #IMPLIED
          isTopLevel                    (Yes | No )  #IMPLIED
          description                   CDATA  #IMPLIED >
<!ELEMENT ManufacturerParts (ManufacturerPart+)>

<!ELEMENT ManufacturerPart (AdditionalAttributes* , ApprovedSupplierList? , History? , Attachments? , AlternateIdentifiers?)>

<!ATTLIST ManufacturerPart  manufacturerPartIdentifier           CDATA  #REQUIRED
                 manufacturerPartUniqueIdentifier      ID     #IMPLIED
                 manufacturerName                      CDATA  #REQUIRED
                 manufacturerContactUniqueIdentifier   IDREF  #IMPLIED
                 globalManufacturerPartStatusCode      (Approved |
                                        QualityHold |
                                        UnderQualification |
                                        Unqualified |
                                        Disqualified |
                                        Obsolete |
                                        Nonpreferred |
                                        Conditional |
                                        Reference |
                                        Other )  #IMPLIED
                 globalManufacturerPartStatusCodeOther CDATA  #IMPLIED
                 referenceNotes                        CDATA  #IMPLIED
                 manufacturerPartType                  CDATA  #IMPLIED
                 description                           CDATA  #IMPLIED
                 owner                                 CDATA  #IMPLIED
                 ownerContactUniqueIdentifier          IDREF  #IMPLIED
                 isTopLevel                            (Yes | No )  #IMPLIED >
<!ELEMENT ProductDataeXchangePackage (AdditionalAttributes* , Items? , Changes? , ManufacturerParts? , SupplierParts? , History? ,
Attachments? , Contacts? , AsBuiltProduct*)>

<!ATTLIST ProductDataeXchangePackage  thisDocumentIdentifier            CDATA  #REQUIRED
                    thisDocumentGenerationDateTime      CDATA  #REQUIRED
                    thisDocumentModificationDateTime    CDATA  #REQUIRED
                    originatedByContactName             CDATA  #IMPLIED
                    originatedByContactUniqueIdentifier IDREF  #IMPLIED
                    packageType                         CDATA  #IMPLIED
                    description                         CDATA  #IMPLIED
                    dataSource                          CDATA  #IMPLIED
                    thisDocumentCopyright               CDATA  #IMPLIED >
<!ELEMENT ReferenceDesignators (ReferenceDesignator+)>

<!ELEMENT ReferenceDesignator EMPTY>

<!ATTLIST ReferenceDesignator  referenceDesignatorName CDATA  #REQUIRED >
<!ELEMENT SerialNumbers (SerialNumberRange* , SerialNumberIdentification*)>
```

```
<!ELEMENT SerialNumberRange EMPTY>

<!ATTLIST SerialNumberRange  firstSerialNumber CDATA  #REQUIRED
                        lastSerialNumber  CDATA  #IMPLIED
                        increment         CDATA  #IMPLIED
                        sequenceNumber    CDATA  #IMPLIED >
<!ELEMENT Approvers (Approver+)>

<!ELEMENT Approver (AdditionalAttributes*)>

<!ATTLIST Approver  globalEngineeringChangeResponseCode      (Approve |
                                         Reject |
                                         Waive |
                                         ApproveWithConditions |
                                         ForwardToAnotherParty |
                                         Other )  #IMPLIED
               globalEngineeringChangeResponseCodeOther CDATA  #IMPLIED
               comments                      CDATA  #IMPLIED
               workflow                      CDATA  #IMPLIED
               globalApproverTypeCode                 (Required |
                                         Optional |
                                         Informational |
                                         Other )  #REQUIRED
               globalApproverTypeCodeOther            CDATA  #IMPLIED
               approverName                       CDATA  #REQUIRED
               approverContactUniqueIdentifier        IDREF  #IMPLIED
               alternateApproverContactUniqueIdentifier IDREF  #IMPLIED
               approvedDate                       CDATA  #IMPLIED
               approverWorkflowStatus                 CDATA  #IMPLIED
               alternateApproverName                  CDATA  #IMPLIED >
<!ELEMENT SupplierParts (SupplierPart+)>

<!ELEMENT SupplierPart (AdditionalAttributes* , History? , Attachments?)>

<!ATTLIST SupplierPart  supplierPartIdentifier          CDATA  #REQUIRED
                  supplierPartUniqueIdentifier      ID     #IMPLIED
                  supplierName                    CDATA  #REQUIRED
                  supplierContactUniqueIdentifier   IDREF  #IMPLIED
                  globalSupplierPartStatusCode      CDATA  #IMPLIED
                  referenceNotes                  CDATA  #IMPLIED
                  supplierPartType                CDATA  #IMPLIED
                  ownerName                       CDATA  #IMPLIED
                  ownerContactUniqueIdentifier      IDREF  #IMPLIED
                  isTopLevel                     (Yes | No )  #IMPLIED
                  description                    CDATA  #IMPLIED
                  globalReturnProductInstructionCode CDATA  #IMPLIED >
<!-- Elements for IPC-2576 -->
<!ELEMENT AsBuiltProduct (ProductInstance* , AdditionalAttributes*)>

<!ATTLIST AsBuiltProduct  globalProductIdentifier   CDATA  #REQUIRED
                   asBuiltProductQuantity    CDATA  #REQUIRED
                   manufacturerUnitOfMeasure CDATA  #IMPLIED
                   customerProductNumber     CDATA  #IMPLIED
                   customerIdentifier       CDATA  #IMPLIED
                   primaryIdentifier        CDATA  #IMPLIED
                   secondaryIdentifier      CDATA  #IMPLIED
                   isTopLevel              (Yes | No )  #IMPLIED >
<!ELEMENT ProductInstance (AdditionalAttributes* , Configuration* , Lot* , WorkOrder* , Packaging* , Process*)>

<!ATTLIST ProductInstance  itemIdentifier            CDATA  #REQUIRED
                    itemUniqueIdentifier      IDREF  #IMPLIED
                    proprietaryProductFamily    CDATA  #IMPLIED
                    globalBusinessIdentifier    CDATA  #IMPLIED
                    globalProductIdentifier     CDATA  #IMPLIED
                    traceabilityType          CDATA  #IMPLIED
                    manufacturerName          CDATA  #IMPLIED
                    productRevision           CDATA  #IMPLIED
                    productVersion            CDATA  #IMPLIED
                    buildDate               CDATA  #REQUIRED
```

```
                    materialIdentifier         CDATA  #REQUIRED
                    forecastProductIdentifer    CDATA  #IMPLIED
                    purchaseOrder              CDATA  #IMPLIED
                    purchaseOrderLineItem      CDATA  #IMPLIED
                    authorizationLineItem      CDATA  #IMPLIED
                    customerSerial             CDATA  #IMPLIED
                    customerPart               CDATA  #IMPLIED
                    customerRevision           CDATA  #IMPLIED
                    sequenceNumber             CDATA  #IMPLIED
                    manufacturingPartStatus    CDATA  #IMPLIED
                    customerVersion            CDATA  #IMPLIED
                    globalLocationIdentifier   CDATA  #IMPLIED
                    globalCountryCode     CDATA  #IMPLIED
                    description              CDATA  #IMPLIED
                    proprietarySerialIdentifier CDATA  #IMPLIED >
<!ELEMENT Configuration EMPTY>

<!ATTLIST Configuration  configurationType CDATA  #REQUIRED
                  configurationData CDATA  #REQUIRED >
<!ELEMENT Lot EMPTY>

<!ATTLIST Lot  lotNumber                CDATA  #REQUIRED
           lotQuantity              CDATA  #IMPLIED
           manufacturerUnitOfMeasure CDATA  #IMPLIED
           globalBusinessIdentifier  CDATA  #IMPLIED
           globalCountryCode     CDATA  #IMPLIED             globalProductIdentifier   CDATA  #IMPLIED
           referenceDesignator      CDATA  #IMPLIED
           lotType                  CDATA  #REQUIRED >
<!ELEMENT WorkOrder EMPTY>

<!ATTLIST WorkOrder  manufacturingWorkOrderType   CDATA  #REQUIRED
               manufacturingWorkOrderNumber CDATA  #REQUIRED >
<!ELEMENT Packaging EMPTY>

<!ATTLIST Packaging  packagingUniqueIdentifier CDATA  #REQUIRED
                 cartonIdentifier         CDATA  #IMPLIED
                 palletIdentifier         CDATA  #IMPLIED >
<!ELEMENT Process EMPTY>

<!ATTLIST Process  stepIdentifier  CDATA  #REQUIRED
              processDateTime CDATA  #IMPLIED
              operation       CDATA  #IMPLIED
              resource        CDATA  #IMPLIED
              router          CDATA  #IMPLIED >
<!ELEMENT AlternateIdentifier EMPTY>

<!ATTLIST AlternateIdentifier  alternateIdentifierNumber CDATA  #IMPLIED
                      description              CDATA  #IMPLIED >
<!ELEMENT AlternateIdentifiers (AlternateIdentifier+)>

<!ELEMENT ContactRoles (ContactRole*)>

<!ATTLIST ContactRoles  groupLabel CDATA  #REQUIRED >
<!ELEMENT ContactRole (GroupRole*)>

<!ATTLIST ContactRole  groupRoleDescription CDATA  #IMPLIED >
<!ELEMENT Role (#PCDATA)>

<!ELEMENT GroupRole EMPTY>

<!ATTLIST GroupRole  role        CDATA  #REQUIRED
               isAlternate  (Yes | No )  #REQUIRED
               description CDATA  #IMPLIED >
<!ELEMENT PublicDigitalCertificate EMPTY>

<!ATTLIST PublicDigitalCertificate  publicDigitalCertificate CDATA  #REQUIRED
                          trustedRoot            CDATA  #IMPLIED
                          trustedRootURI         CDATA  #IMPLIED >
<!ELEMENT SerialNumberIdentification EMPTY>
```

```
<!ATTLIST SerialNumberIdentification  sequenceNumber            CDATA  #IMPLIED
                    ProprietarySerialIdentifier CDATA  #IMPLIED >
```

Appendix A – IPC Web-based Standards (IPC25XX)

The web-based standards (IPC 25XX) are designed to foster application integration and electronic commerce through data and information interchange standards based on XML. There is no need for a common object model, programming language, network protocol, persistent storage mechanism or operating system for two applications to exchange XML messages formatted using the web-based standards. The two applications simply need to be able to format, transmit, receive and consume a standardized XML message.

A web-based standards series has been identified for each of the value-added activities occurring throughout the product life cycle of an electronics product. The web-based standards are:

IPC-2500 – Framework Standard

IPC-2510 – Product Data Representation

IPC-2520 – Product Data Quality

IPC-2530 – Surface Mount Equipment Standard Recipe File Format

IPC-2540 – Shop Floor Equipment Communications

IPC-2550 – Manufacturing Execution Systems Communications

IPC-2560 – Enterprise Resource Planning Systems Communications

IPC-2570 – Supply Chain Communications

Table A-1 shows the correlation of the different standards in each of the series. Although not every standard has been started, the figure represents a coordinated opportunity to maintain consistency throughout the standard development cycle.

Table A-1 CAD/CAM Standardization

IPC Number/ Function	-xxx1 Generic	-xxx2 Administ	-xxx3 Documnt	-xxx4 Board Fabricat	-xxx5 Bare Bd Test	-xxx6 Assy Manufac	-xxx7 Assy/ Test/ Insp.	-xxx8 Comp. & Material	-xxx9 Informa. Modeling
IPC-2500 CAMX Framework	IPC-2501 PINS								
IPC-2510 GenCAM Product Data	IPC-2511A (Pub)	IPC-2512A (Pub)	IPC-2513A (Pub)	IPC-2514A (Pub)	IPC-2515A (Pub)	IPC-2516A (Pub)	IPC-2517A (Pub)	IPC-2518A (Pub)	IPC-2519A (Pub)
IPC-2520 Quality Product Data				IPC-2524 (Pub)					
IPC-2530 SRFF Process Data Recipe file	IPC-2531 ANSI Draft								
IPC-2540 Shop Floor Communicate	IPC-2541 (Pub)					IPC-2546 (Pub)	IPC-2547 2nd IF		
IPC-2550 Execution Communicate	IPC-2551 PINS			IPC-2554 Working draft		IPC-2556 PINS			
IPC-2560 Enterprise Communicate									
IPC-2570 Supply Chain Communicate	IPC-2571 (Pub)					IPC-2576 (Pub)	IPC-2577 Proposal	IPC-2578 (Pub)	